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Srinivas Kandala

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Chernoff Vilhauer McClung & Stenzel  
1600 ODS Tower  
601 SW Second Avenue  
Portland, OR 97204

EXAMINER

PERILLA, JASON M

ART UNIT

PAPER NUMBER

2634

DATE MAILED: 12/28/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

09/614,784

Applicant(s)

KANDALA ET AL.

Examiner

Jason M Perilla

Art Unit

2634

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 23 September 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 17-22 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 17-22 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 12 July 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948)                                    | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

### **DETAILED ACTION**

1. Claims 17-22 are pending in the instant application.

#### ***Response to Arguments***

2. Applicant's arguments filed September 23, 2004 have been fully considered but they are not persuasive.

Regarding the Applicant's arguments over the rejection of claims 17 through 22 under 35 USC § 103(a) as being unpatentable over Harada et al (US 6115435; hereafter "Harada") in view of Viterbi et al (IEEE Transactions on communications, Vol. 41, No. 4, April 1993; hereafter "Viterbi"), the Applicant's arguments fail to properly consider the references Harada and Viterbi. Where the rejections previously set forth may not be clear to the Applicant, they are hereby re-applied to the claims and clearly set forth. Regarding the Applicant's assertion that the references Harada and Viterbi would not work together, it is noted by the Examiner that there is no matter regarding *if* they would work together because Harada indeed uses a Viterbi soft decoder (fig. 14, ref. 341; fig. 15, ref. 442; col. 7, lines 20-35) as part of embodiments 6 and 7. The Applicant's argument that there is no motivation to combine is moot because the reference to Viterbi is not "combined" with Harada. Rather, it serves to exemplify a process by which an exemplary Viterbi soft decoder performs. Namely, it illustrates the use of a log likelihood ratio by a Viterbi soft decoder. Indeed, the combination of Harada in view of Viterbi is proper and obvious.

#### ***Claim Objections***

3. Claims 17-22 are objected to because of the following informalities:

Regarding claim 17, the method steps (c) and (d) refer to a bit although dependent claims may refer to bits. The independent and dependent claims should agree regarding the number of bits associated with a greater and less reliability.

Regarding claim 19, in lines 3 and 4, "said bit" should be replaced by --said bit associated with a lesser reliability—in each of lines 3 and 4.

Regarding claim 21, in lines 3-6, "providing a soft decision value to bits of said demodulated multilevel signal associated a measure of reliability having values not exceeding a limiting value of said range" should be replaced by -- providing a soft decision value to bits associated with a lesser reliability having values not exceeding the limited value of said predetermined range--.

Regarding claim 22, in line 1, "said limiting value" should be replaced by --the limited value--, and, "equals" should be replaced by --is--.

Appropriate correction is required.

***Claim Rejections - 35 USC § 112***

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 18 and 21-22 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claim 18, the claim is indefinite because the said reliability is lacking a definite antecedent basis in parent claim 17. Parent claim 17 defines a greater reliability

and a lesser reliability but does not define a said reliability. Therefore, a particular and definite interpretation of the claim may not be made.

Regarding claim 21, the claim is indefinite because the measure of reliability is lacking a definite antecedent basis in parent claim 17. Parent claim 17 defines a greater reliability and a lesser reliability but does not define a measure of reliability. Therefore, a particular and definite interpretation of the claim may not be made.

Regarding claim 22, the claim is rejected as being based upon a rejected parent claim.

### ***Claim Rejections - 35 USC § 102***

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 17, 19 and 21 are rejected under 35 U.S.C. 102(e) as being clearly anticipated by Harada.

Regarding claim 17, Harada discloses a method of demodulating a multi-level or QAM signals (fig. 4; col. 1, line 55) comprising: (a) identifying at least one signal constellation vector (fig. 4, unfilled circles "1000", "1010", etc.) proximate to said multilevel signal(s) (fig. 4, refs. a-c); (b) comparing a reliability of at least two bits of said constellation vector of said demodulated multilevel signal; (c) assigning a hard decision value to a bit associated with a greater reliability; and (d) assigning a soft decision value to a bit associated with a lesser reliability. Hard decisions are assigned to bits representing the demodulated signals (fig. 4, ref. a-c) according to the non-varying points of the constellation vectors (col. 4, lines 4-7), and soft decisions are made for the varying points of the constellation vectors (col. 4, lines 7-11). At least one (four in the

case of signal point "a" of figure 4 – shown in detail in figure 5) signal constellation vectors (fig. 4, refs. "a", "0010", "0000", "0011", and "0001") proximate to the multilevel signal ("a") are identified, and a reliability measure or soft decision of the demodulated bit ("a") is found for the bits of varying points among the constellation vectors. Note the constellation vectors of signal "a" in figure 4 referenced by their four bit binary values (ref. "0010", "0000", "0011, and "0001"). A reliability measure is taken depending on the neighborhood that the demodulated bit occupies (col. 1, line 48; col. 3, line 63). The identification at least one (four in the example of signal point "a") constellation vectors proximate to signal "a" of figure 5 are constellations "0010", "0000", "0011, and "0001", and the bits of non-varying values are bits y2 and y3 (the two MSB's shown as astericks). *The specification of Harada et al discloses that according to the position of the demodulated multilevel signal (signal "a"), the reliability measure or hard decisions for bit y1 is 2 and the reliability measure for bit y0 is 6. Therefore, these are the hard decision values which are associated with a greater reliability because they do not change in the neighborhood of the demodulated signal "a".* The soft decision values are thereby assigned to the bits that do vary (which thereby have lesser reliability) according to the soft decision axis shown in figure 5. Figure 5 shows that the soft decision values are y1=2 and y0=6.

Regarding claim 19, Harada discloses the limitations of claim 17 as applied above. Further, Harada discloses that the step of assigning a soft decision value to the bits associated with a lesser reliability comprises the steps of: (a) assigning a value to said bit; and (b) assigning a measure of reliability to said bit. As shown in figure 5, the

soft decision values are assigned to the bits that do vary (which thereby have lesser reliability) according to the soft decision axis shown in figure 5. Figure 5 shows that the soft decision values are  $y_1=2$  and  $y_0=6$  for the received signal "a". However, the assignment of a value to the bits of lesser reliability also entails the assignment of a measure of reliability of the bit(s) because the assignment of the values contains information regarding the measure of reliability of that bit. For example, according to figure 5, the soft value of bit  $y_0$  is 6. However, as known by one having skill in the art, the actual or final value of the soft bit  $y_0$  must be either a 0 or 1 as the definition of a "bit" entails. Because the range of the values for the soft bit  $y_0$  may be between 0 and 7 wherein 0 relates to a strong "0" for the bit value and 7 relates to a strong "1" for the bit value (see fig. 5) the values  $y_1=2$  and  $y_0=6$  are not only an assigned value to said bits but also a measure of reliability of the final value of the bits which will be a 1 or 0.

Regarding claim 21, Harada discloses the limitations of claim 17 as applied above. Further, Harada discloses the further steps of (a) limiting said measure of reliability to a predetermined range; and (b) providing a soft decision value to bits of said demodulated multilevel signal associated a measure of reliability having values not exceeding a limiting value of said range. The limited measure of reliability is either limited by the hard decision value limitations being the bits within a received signal neighborhood which do not vary (a limited number of bits) or by the limitation of the possible soft decision values which, as shown in figure 4, are limited to be within the range of 0 to 7 for each bit decision. The bit values of the soft decision bits will not

exceed the range of 0 to 7. Therefore, the limited range of the soft decision values for the bits of lesser reliability is from 0 to 7 and may not exceed this range.

***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Harada in view of Viterbi.

Regarding claim 18, Harada discloses the limitations of claim 17 as applied above. Further, Harada discloses a method of demodulating a multilevel signal using a Viterbi decoder (fig. 14, ref 341; col. 7, lines 1-40) as part of the sixth and seventh embodiments. Harada does not explicitly disclose that the Viterbi decoder measures the reliability by a log likelihood ratio. However, Viterbi discloses a soft decoder that compares the reliability of at least two bits, assigns hard decision values to bits associated with greater reliability, and assigns soft decision values to bits associated with lesser reliability depending on their log likelihood ratio (pg. 561, col. 1, III. Signal Statistics, Metric Calculation, and Soft Decoder Performance). The use of a Viterbi soft decoder is already established by Harada, and Viterbi illustrates an exemplary embodiment of the Viterbi soft decoder which one skilled in the art would be motivated to use or, alternatively, may already be used by Harada as suggested by the process identified by Viterbi which a Viterbi soft decoder performs. Therefore, it would have



been obvious to one having ordinary skill in the art at the time the invention was made to utilize the Viterbi decoder of the exemplary description by Viterbi for the Viterbi decoder disclosed by Harada.

9. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Harada.


Regarding claim 22, Harada discloses the limitations of claim 21 as applied above. Further, Harada teaches that the limited range does not have to be from 0 to 7 but could be a nine valued range from -4 to 4 (col. 4, lines 48-55). Further, a greater number of bits within a neighborhood which must be assigned soft decision values would require a more accurate soft decision value for each of the bits for the accurate determination of the actual values of the bits. One skilled in the art would recognize that in a neighborhood with less bits having a greater reliability and more bits having a lesser reliability, it would be advantageous to utilize a greater range of possible soft decision values to create a more accurate symbol decision. For instance, a range of 9 rather than 8 may be used as taught by Harada. Therefore it would have been obvious to one having ordinary skill in the art at the time which the invention was made to utilize a range which is a function of a number of bits with a lesser degree of reliability because a greater range of soft decision values will increase the accuracy of the greater number of bits that have lesser reliability to increase the overall symbol decision accuracy.

### ***Conclusion***

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason M Perilla whose telephone number is (571) 272-3055. The examiner can normally be reached on M-F 8-5 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Chin can be reached on (571) 272-3056. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

  
Jason M. Perilla  
December 20, 2004

jmp

  
**CHIEH M. FAN**  
**PRIMARY EXAMINER**